spirit, and insists on the necessity of the latter as the foundation for those powers of initiative and of intelligent activity without which progress is impossible. Prof. Appell points out that the object of higher education is three-fold—to make, to teach, and to apply science—and considers in detail how far the educational system of France attains these objects. He finds much overlapping, and directs special attention to the large amount of teaching of pure science which goes on in technical schools the principal function of which, he urges, should be to teach technical applications to pupils already well grounded in science at the universities or other schools of university type. Those interested in higher education in this country will find much food for thought in Prof. Appell's address, and many will ask, Are our institutes for higher education carrying out their duty of making science as they ought? while more will want to know how much of the energy of our polytechnics and technical schools is devoted to teaching pupils the laws of motion or how to solve simple equations.

THE latest article of a series published by the *Times* on American life is devoted to "Colleges and Character." After mentioning the rapid growth of the universities, which in 1904 already had 119,496 undergraduates, the writer agrees with the Rhodes scholar who reported that from the sole standpoint of scholarship it was not necessary for him to leave America. On the other hand, the author of the article lays blame on the "elective" system, which presupposes that the average youth of eighteen, fresh from school, has defined aptitudes, understands himself, has adequately given shape to his ultimate purpose, and can be depended upon to select the studies best adapted to the achievement of his destiny. Nevertheless, he considers that the fundamental idea of electives is sound, but that the reaction from the old rigid courses of instruction has gone too far. A student may graduate by passing in four entirely disconnected subjects in each of four successive years; moreover, there is a temptation to seek "soft options." On the other hand, we may observe that it is commoner in America to find commercial men who, by pursuing the somewhat haphazard sampling of studies which the elective system permits, have acquired intelligent appreciation of, say, comparative religion and Röntgen rays. In England men of the same class rarely attempt any university study. The author expects that "electives" will never be disallowed in the future, but will be intelligently restricted, so as to secure that all students—not merely such as choose—will be subjected to the discipline proper to university life on its intellectual side.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 18.—"An Electrical Method of Counting the Number of α Particles from Radio-active Substances." By Prof. E. **Rutherford**, F.R.S., and Dr. H. **Geiger**.

(1) By employing the principle of magnification of ionisation by collision, the electrical effect due to a single α particle may be increased sufficiently to be readily observed by an ordinary electrometer.

(2) The magnitude of the electrical effect due to an α particle depends upon the voltage employed, and can be varied within wide limits.

(3) This electric method can be employed to count the α particles expelled from all types of active matter which emit α rays.

(4) Using radium C as a source of α rays, the total number of α particles expelled per second from 1 gram of radium have been accurately counted. For radium in equilibrium, this number is $3 \cdot 4 \times 10^{10}$ for radium itself and for each of its three α-ray products.

(5) The number of scintillations observed on a properly prepared screen of zinc sulphide is, within the limit of experimental error, equal to the number of α particles falling upon it, as counted by the electric method. It follows from this that each α particle produces a scintillation.

(6) The distribution of the α particles in time is governed by the laws of probability.

The authors have previously pointed out that the principle of magnification of ionisation by collision can be used to extend widely the already delicate methods of detection of radio-active matter. Calculation shows that under good conditions it should be possible by this method to detect a single β particle, and consequently to count directly the number of β particles expelled from radio-active substances.

Further work is in progress on this and other problems that have arisen out of these investigations.

EDINBURGH.

Royal Society, July 13.—Prof. Crum Brown, vice-president, in the chair.—An improved method of esterification: G. E. **Gibson**.—Nitric anhydride as a nitrating agent: G. E. **Gibson**.—The significance of maximum electrolytic conductivity: Prof. John **Gibson**.—The variation of Young's modulus under an electric current, part ii.: Henry **Walker**. In these experiments it was shown that the curious changes in the value of Young's modulus when the iron, steel, copper, or platinum wire was heated by an electric current were not observed when the wire was stretched under a load approaching the limits of elasticity, and that when the wire was heated by ordinary methods no peculiarity in the change of Young's modulus was found to exist.—The theory of general determinants in the historical order of development up to 1860: Dr. Thomas **Muir**.

July 20.—Dr. R. H. Traquair, vice-president, in the chair.—A sensitive state induced in magnetic substances and materials by thermal treatment, part ii.: J. G. **Gray** and A. D. **Ross**. The sensitive state induced by annealing the material from moderately high temperatures was reduced by jarring, but could not be completely obliterated by this means. A strong sensitive state was induced when the material was cooled from room temperature to that of liquid air, or when it was heated from the temperature of liquid air to that of the room; but when the material was cooled to the temperature of liquid air and then heated again, only a small increase was observed in the susceptibility. The effect was associated with temperature change, and was not apparently influenced by the length of time the material was kept at the high or low temperature.—The structure of *Turrilepas peachi* and its allies: F. R. Cowper **Reed**. An examination of type-specimens from Whitehouse Bay and of further material shows that the organism is bilaterally symmetrical. There are four series of plates, a double median longitudinal row of small triangular plates in close contact overlying the larger and more elongated lateral kite-shaped plates. The latter are arranged in pairs on each side, extending (in the middle part of the body) nearly at right angles to the axial line, but becoming inclined more acutely forwards towards the anterior end. The lateral plates also overlap each other for about half their width, and bear on their outer surface a median longitudinal impressed narrow groove which appears as a fold on the reverse side of the plates. The characters of *Turrilepas scotica* were discussed in the light of the newly discovered structure of *T. peachi*, and of fresh material from the Balcletchie beds, and the Scottish species were compared with the undescribed forms from the Ordovician beds of England and Wales, and with the American genera Strobilepis and Lepidocoleus.—The recalescence of nickel: T. A. **Lindsay**. Two cylinders, one of nickel and one of copper, were allowed to cool simultaneously from a high temperature, the difference of temperature at each instant of time being measured by a thermoelectric couple with the two junctions in the heart of their respective cylinders. The difference curve of cooling so obtained indicated recalescence phenomena at temperatures of 650° C., 515° C., and within the range 370° C. to 285° C.—Note on the study of polarisation by means of the Dolezalek electrometer: A. F. **Ewan**. The method afforded a very delicate test of the independence of polarisation on the potential of the electrode, and it was also found possible to extend the time curve of polarisation through a much greater range than had been possible with any one of the other methods. Interesting corroboration was obtained of Bouty's and Wiedeburg's

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formulæ.—Preliminary note on the action of nitric anhydride on mucic acid: Prof. Crum **Brown** and G. E. **Gibson.**—The meteorology of the Weddell quadrant and adjacent areas: R. C. **Mossman.** This was a general discussion, restricted to the more prominent elements of climate, of the meteorological conditions of Antarctic and sub-Antarctic latitudes, with the aim of correlating the weather changes of these adjacent regions.

PARIS.

Academy of Sciences, August 10.—M. Maurice Levy in the chair.—A problem relating to the theory of orthogonal systems and to the method of the mobile trihedron: Gaston **Darboux.**—Complement to an earlier note on the manner in which the changes in magnitude of the two right lines joining the sun and a planet to the earth are related to their changes in direction when the planet moves in the plane of the ecliptic: J. **Boussinesq.**—The registration of the upper layer of calcium in the solar atmosphere: H. **Deslandres** and L. **d'Azambuja.** A special study has been made of the calcium line K_3. The dark calcium filaments appear in all latitudes, and are clearest at the edges. They are the seat of considerable radial movements. The filaments, which form the principal character of the upper layer of the solar atmosphere, are evidently related to the general circulation of the vapours, to the accidental variations of their velocity of rotation, and possibly also to the formation and dissipation of faculæ.—The rotation of the sun: A. **Perot.** An application of the method of interference spectroscopy devised by the author and M. Fabry to the lines of wave-lengths (Rowland) 5202·4, 5349·6 (Ca), 6065·7 (Fe), and 6122·4 (Ca), the angular velocities and times of revolution of which are given. The equatorial acceleration is very marked for the two calcium lines studied, whilst the two others are normal in this respect.—Equations all of whose roots are real: A. **Pellet.**—Some remarkable movements: M. **Haag.**—The action of the radium emanation on solutions of copper salts: Mme. **Curie** and Mlle. **Gleditsch** (see p. 372).—A new application of superposition without confusion of small electric oscillations in the same circuit: E. **Mercadier.** The signals are produced by alternating currents controlled by electro-diapasons, and are received on vibrating plates tuned to exact unison. It has been found possible to superpose in the same circuit simultaneously and in both directions the signals arising from twelve electrodiapasons on lines from 5 to 700 kilometres in length. Messages on this system have been successfully exchanged between Paris and Marseilles.—The physicochemical analysis of wines; Paul **Dutoit** and Marcel **Duboux.** An application of D. Berthelot's method of electrical conductivities to the titration of acids and bases in wines.—Researches on the cause of the odour acquired by air submitted to the ultra-violet radiations emitted by a mercury vapour lamp: H. **Bordier** and T. **Nogier.** It is definitely proved that this odour is not due either to the production of ozone or nitrous fumes. The circulation of gases free from oxygen, such as nitrogen or carbon dioxide, causes the same odour.—The intradermo-reaction of tuberculin: Ch. **Mantoux.** Details are given of the method of applying this test, which has been compared in fifty-two cases with the cuti-reaction. The test failed in only two cases, and has the advantages of simplicity of execution and greater sensibility.—The culture of the virus of fowl plague *in vitro*: E. **Marchoux.** This disease is one in which no organism has been detected, probably on account of its extreme minuteness. It has been reproduced in ten successive stab cultures, retaining its virulence.—Contribution to the study of the Continental *facies*: Palæozoic landslips: Stanislas **Meunier.**—The kaolin-bearing rocks of the basin of Lake Nepigon, Canada: F. Romanet **du Caillaud.**

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), part ii. for 1908, contains the following memoirs communicated to the society:—

July 27, 1907.—Records of the specific conductivity of atmospheric air: H. **Schering.**

February 21, 1908.—Determination of the vertex and apex (of the stellar system), on the ellipsoidal hypothesis, from a small number of observed proper motions: K. **Schwarzschild.**

March 7.—Seismic records in Göttingen for 1906: K. **Zoeppritz.**

March 21.—The generation of linear ternary substitutions from a minimal number of fundamental substitutions: W. Fr. **Meyer.**

The business communications of the society, part i. for 1908, include a report on the Samoa Observatory for 1907, the address presented to the University of Upsala at the Linnæus celebration, and a memorial notice of Lord Kelvin by W. **Voigt.**

CAPE TOWN.

Royal Society of South Africa, July 15.—Mr. S. S. Hough, F.R.S., president, in the chair.—Preliminary note on the diurnal variation of level at Kimberley: J. R. **Sutton.** This paper gives the preliminary results of observations made during the course of three years upon the variation of the level of the ground as recorded by a large horizontal pendulum of a special design made for the author by the Cambridge Scientific Instrument Co. It appears from the results that the movements in the surface of the ground which set up corresponding movements on the pendulum at Kimberley are very great. The maximum westerly elongation of the extremity of the pendulum occurs about $5\frac{1}{2}$ a.m., the maximum easterly about $4\frac{1}{4}$ p.m., the median positions a little before 11 a.m. and $9\frac{1}{2}$ p.m. Geometrically these movements may be represented on the hypothesis that the hemisphere facing the sun bulges out, forming a sort of meniscus to the geosphere. The enormous rise and fall of the surface of the land that such a supposition would postulate are, however, mechanically difficult. The range of the pendulum's excursion from west to east during the day is twice as great in winter as it is in summer.

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